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Study on the Clinical Value of Preventing Venous Thromboembolism during the Perioperative Period of Gynecological Oncology

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Abstract: The purpose of this study is to explore the clinical value of preventing venous thromboembolism during the perioperative period of gynecological oncology.**Methods:** A total of 60 patients voluntarily participated in this study and received diagnosis and treatment (gynecological cancer patients) at our hospital. After signing informed consent, they were divided into two groups for experimental comparison. The study period was from May 2021 to May 2022. The treatment methods were different, but the comparison indicators were the same, with 30 patients in each group. Traditional therapy and low molecular weight heparin sodium therapy were employed. This study used coagulation, fibrinolysis, and postoperative lower extremity deep venous thrombosis formation as controls. Results: By comparing the changes in coagulation function and fibrinolysis system indicators and the incidence of LEDVT after surgery, the observation group showed superiority ($P < 0.05$).**Conclusion:** For gynecological cancer patients, low molecular weight heparin sodium therapy can effectively prevent venous thrombosis with significant efficacy.

Keywords: gynecological oncology; surgery; coagulation indicators; low molecular weight heparin sodium

Deep venous thrombosis (DVT) of the lower extremities is a serious health condition with mechanisms that are not yet fully understood [1]. Risk factors for the formation of lower extremity DVT after surgery for female gynecological malignancies include hypercoagulability of the blood, surgical tissue damage releasing coagulation activators, prolonged immobility post-surgery leading to impaired blood flow and dehydration due to inadequate fluid intake [2]. Additionally, the use of hemostatic drugs post-surgery can enhance the patient's coagulation function. The occurrence of lower extremity DVT after surgery for gynecological tumors is an important factor affecting patient prognosis and coagulation parameters. In severe cases, pulmonary embolism may occur, posing a life-threatening risk to patients. Therefore, prevention and treatment are essential. In recent years, prophylactic treatment with mainly low molecular weight heparin has been used during the perioperative period of gynecological tumors. The following report provides further details:

1. Data and Methods

1.1 Basic Information

The research primarily focuses on including patients with gynecological tumors in the experimental content. The study was conducted from May 2021 to May 2022, aiming to explore the effects of different treatment

methods on patients with gynecological cancer. Patients were divided into different groups, with variations in treatment methods. There were a total of 60 patients, and the general characteristics of the two groups were analyzed. Basic data: The maximum age of the patients was 75 years, the minimum was 43 years, and the average age was (61.74±2.63) years. Upon comparison, there were no significant differences in the general data between the two groups ($P > 0.05$).

Inclusion criteria: All cases were confirmed through clinical symptoms, physical signs, imaging, and pathological sections, with no evidence of distant metastasis or cancer emboli, meeting the indications for surgery. Before surgery, Doppler ultrasound of the lower limbs showed no deep vein thrombosis in the lower limbs; laboratory examinations revealed no abnormalities in coagulation and fibrinolysis. This study was approved by the ethics committee, and patients provided signed consent forms.

Exclusion criteria: Abnormal coagulation and fibrinolysis systems, anemia, abnormal platelet counts, bleeding disorders, hyperlipidemia, history of blood transfusion, history of lower limb deep vein thrombosis formation; high-risk deep vein thrombosis (3~5); cases with a history of abdominal surgery and distant metastasis; use of anticoagulants, fibrinolytic drugs, or other medications within 2 weeks before surgery; patients unable to cooperate.

1.2 Methods

Control Group: Conventional treatment was administered. Before surgery, patients were assessed for LEDVT risk factors, and personalized intervention plans were formulated based on the assessment results. Surgeons were advised to enhance their technical skills, avoid unnecessary pressure, and reduce collateral damage. Patients were encouraged to mobilize early and get out of bed promptly. When conditions permitted, elastic bandages were used, followed by layered compression to accelerate blood circulation in the lower limbs, increase venous pressure, and thereby reduce or prevent the occurrence of deep vein thrombosis in the lower limbs. During treatment, antibiotics were administered as needed, and attention was paid to adequate hydration to prevent blood concentration due to dehydration. To avoid increasing blood coagulation, the use of hemostatic agents was minimized as much as possible.

Experimental Group: In addition to the interventions in the control group, the experimental group received subcutaneous injections of low molecular weight heparin sodium solution (produced by Hangzhou Jiuyuan Company, trade name: Jipailin, Chinese drug approval number: H19990306, specification: 5000IU/0.5mL/ampoule). Two hours and eight hours before surgery, Jipailin was injected subcutaneously at a dose of 2500 IU. Starting from the day of surgery, Jipailin was administered subcutaneously at a dose of 5000 IU/d in the early morning, once a day, for a period of 7 days.

1.3 Observational Indicators

Activated Partial Thromboplastin Time (APTT), Fibrinogen (FIB), D-dimer (D-D), Antithrombin III (AT-III), and tissue plasminogen activator (t-PA). The occurrence rate of deep vein thrombosis in the lower limbs was compared between the two groups.

1.4 Statistical Methods

The statistical analysis was performed using SPSS 20.0 software. The data were analyzed using the t-test for continuous variables, expressed as mean ± standard deviation (SD), and the Chi-square (X^2) test for categorical data, expressed as percentages (%). A significance level of $P < 0.05$ was considered statistically significant.

2. Results

2.1 Comparison of Coagulation Parameters as shown in Table 1.

Table 1: Analysis and Evaluation of Coagulation Parameters in Two Groups($\overline{x} \pm s$)

Group	Number	PT(s)		APTT(s)		FIB(g/L)	
		Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Test Group	30	12.78±2.21	13.36±1.30	28.58±2.41	31.75±1.12	2.57±0.51	3.09±0.44
Control Group	30	12.55±2.21	11.49±3.31	28.95±2.31	26.78±3.12	2.56±0.55	3.46±0.51
t-value	-	0.4031	2.8802	0.6071	8.2119	0.0730	3.0087
P-value	-	0.6884	0.0056	0.5462	0.0000	0.9420	0.0039

2.2 The fibrinolytic system indexes of the two groups were compared, as shown in Table 2.

Table 2: Comparison of fibrinolytic system indexes between the two groups before and after intervention($\bar{x} \pm s$)

Group	D-D(μg/mL)		AT-III(g/L)		t-PA(ng/L)	
	Before Treatment	After Treatment	Before Treatment	After Treatment	Before Treatment	After Treatment
Test Group (n = 30)	0.53±0.26	0.63±0.11	0.29±0.11	0.35±0.13	5.74±1.63	5.37±1.21
Control Group (n = 30)	0.54±0.28	0.78±0.12	0.28±0.12	0.24±0.09	5.78±1.41	4.09±1.23
t	0.1433	5.0469	0.3365	3.8105	0.1017	4.0633
P	0.8865	0.0000	0.7377	0.0003	0.9194	0.0001

3 Incidence of deep vein thrombosis in lower extremities

The incidence of deep vein thrombosis in lower extremities showed that there were 0 cases in the experimental group and 5 cases (16.67%) in the control group, with significant differences.

Discussion

Low flow, hypercoagulability, and vascular wall damage are important factors in the pathogenesis of lower extremity deep vein thrombosis (DVT), with slow blood flow in the lower extremities being the primary cause [3]. Prolonged bed rest postoperatively, pneumoperitoneum formation during laparoscopic surgery leading to increased intra-abdominal pressure, and subsequent obstruction of inferior vena cava return result in reduced venous blood flow in the lower limbs. Surgical trauma can enhance platelet stress-induced aggregation and release coagulation activation factors due to injury, thereby activating the extrinsic coagulation pathway [4]. Postoperative fasting, dehydration, and other factors can lead to blood concentration, and the use of hemostatic agents can promote coagulation. Tumor patients often have abnormal platelet aggregation and adhesion, with tumor cells secreting tissue factors, coagulation factors, and procoagulants released from necrotic tumor tissue, among other substances. During pelvic lymph node dissection and vessel clearance, local venous damage combined with slow blood flow and hypercoagulability can easily lead to vascular endothelial damage [5]. The incidence of lower extremity deep vein thrombosis in gynecological tumor patients postoperatively significantly increases, with severe cases leading to pulmonary embolism and life-threatening situations [6].

Low molecular weight heparin (LMWH) is isolated from the liver using enzymatic or chemical methods, with a molecular weight around 4000-6000 Daltons. Modern pharmacological research shows that LMWH has good anticoagulant function, elevating PT, APTT, and FIB activities and exhibiting significant inhibitory effects on both endogenous and exogenous coagulation. Literature reports show that LMWH can significantly inhibit the activity of factor IIa, reduce aggregation, decrease blood viscosity, improve microcirculation, reduce hypercoagulability, alleviate or delay thrombosis formation in veins and arteries. LMWH is an AT-III dependent anticoagulant inhibitor that enhances the activity of the fibrinolytic system (D-D, AT-III, t-PA), increases t-PA release, activates tissue plasminogen activators in VECs, enhances fibrinolysis, and exhibits antithrombotic effects. Heparin can prevent cancer cells from invading NK cells, block their cytotoxicity, effectively inhibit the interaction between tumor cells and blood cells, thus achieving anti-metastatic effects, inhibiting heparinase, inhibiting VEGF secretion, and significantly exerting anti-cancer effects, mainly by inhibiting thrombin and tissue factor production, indirectly exerting antiplatelet effects. Studies have shown that the application of low molecular weight heparin sodium in the treatment of advanced cancer can not only reduce the incidence of lower extremity deep vein thrombosis but also improve the survival of cancer patients [7]. APTT and FIB are commonly used coagulation indicators in clinical practice. PT is an overload test of the extrinsic coagulation system. If the measured value is short, it indicates whether the patient's blood is in a hypercoagulable state or may also indicate thrombotic disease. APTT is an index of the overload test of the endogenous coagulation system. If the measured value is shortened, it indicates an increase in coagulation factor activity or the entry of procoagulants into the

blood, leading to hypercoagulability. These can be used to monitor the progress of anticoagulant therapy. FIB is a coagulation factor that plays a crucial role in the coagulation process. FIB enhances platelet aggregation, increasing blood viscosity and peripheral resistance. It induces the growth, proliferation, and contraction of vascular endothelial cells, leading to endothelial cell damage and subsequent red blood cell adhesion and thrombus formation. An elevated FIB content in the blood indicates increased blood viscosity, slowed blood flow, and hypercoagulability, making thrombosis more likely. The fibrinolytic system is the fourth stage of the coagulation process, characterized by markers such as D-D, AT-III, and t-PA. D-dimer (D-D) is a specific degradation product produced by fibrinolysis. D-D is currently the only indicator that reflects the degree of thrombolysis and is important for early diagnosis, screening, and evaluating thrombolytic effects. AT-III is an anticoagulant substance secreted by the liver and vascular endothelial cells. It exerts anticoagulant effects by forming a complex with arginine-threonine peptides (AT-III). It is considered a potent anticoagulant drug. Insufficient synthesis or excessive consumption of AT-III leads to poor blood flow, making thrombosis likely. t-PA is a serine protease secreted by endothelial cells that can activate plasminogen and participate in the degradation of fibrin. Excessive consumption or lack of t-PA production in the body leads to a significant decrease in plasma concentration, resulting in hypercoagulability.

In conclusion, due to physiological, pathological, and surgical factors, the probability of LEDVT in gynecological cancer patients is high, significantly affecting the postoperative recovery and overall well-being of patients. Clinically, prophylactic application of heparin during the perioperative period in gynecological cancer patients can significantly improve coagulation, fibrinolysis, and other indicators, reduce the incidence of postoperative LEDVT, and facilitate disease recovery while reducing medical risks. Conclusion: This product has good safety and can be used for the prevention and treatment of perioperative LEDVT in gynecological tumor patients.

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